Prevalence of Pneumococcus Carriers: Specific Types in Epidemic and Non-Epidemic Areas*

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THE pneumonias have generally been considered endemic, rather than epidemic diseases, although references to epidemics of pneumonia may be found even in the early medical literature.[1, 2] In recent years, epidemics of pneumonia due to specific types of pneumococci have been observed with increasing frequency, and certain types have been shown to be more frequently associated with epidemic pneumonia than others. A number of institutional outbreaks of pneumonia due to Type I [3] and Type II [4, 5] have been reported. Community outbreaks in which Type I infection predominated have been observed by Sydenstricker and Sutton [6] in Maryland in 1917; more recently in Germany by Gundel [7]; and by Gilman and Anderson in Massachusetts.[8] An explosive epidemic of colds, bronchitis, and pneumonia in a child-caring institution was reported by Schroder and Cooper [9] in 1930, in which Type V pneumococcus infection apparently predominated.

As a result of the emphasis placed upon early typing and specific serum treatment in pneumonia as a part of the control program in New York State during recent years, there has been a marked increase in the proportion of cases typed, and the number of types for which sputum specimens have been tested has increased in most laboratories. During 1938, all approved laboratories in the state have been supplied with diagnostic sera for at least Types I, II, V, VII, and VIII.

Table 1 shows comparative prevalence of pneumonia of the common types during 1938 in certain counties in the state, in which typing was reasonably complete, and in which laboratory facilities were adequate. In almost all counties Type I infection predominated. There was considerable variation in the proportion of typed cases found to be due to Type V. The counties listed in Table 1 are roughly in geographical order, from the western to the eastern part of the state, and the two counties in which over 20 per cent of the typed cases were Type V are adjacent and located at approximately the geographical center of the state. The concentration of Type V pneumonia in this central area was quite marked during 1938.

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TABLE 1

Pneumonia and Pneumococcus Type Incidence in Certain Counties
New York State—1938

County	Total Reported Cases of Pneumonia	Cases Typed		Incidence of Certain Types									
				I		II		V		VII		VIII	
		Number	Per cent	Number	Per cent Typed Cases	Number	Per cent Typed Cases	Number	Per cent Typed Cases	Number	Per cent Typed Cases	Number	Per cent Typed Cases
Cattaraugus	197	77	39.1	14	18.2	4	5.2	6	7.8	2	2.6	4	5.2
Livingston	175	54	30.8	12	22.2	..	...	1	1.8	9	16.7	2	3.7
Steuben	360	172	47.8	46	26.7	8	4.6	19	11.0	12	7.0	12	7.0
Onondaga *	327	171	52.3	32	18.7	3	1.8	35	20.5	11	6.4	8	4.7
Madison	154	75	48.7	7	9.3	2	2.7	22	29.3	2	2.7	2	2.7
Otsego	189	117	61.9	30	25.6	3	2.6	8	6.8	9	7.7	6	5.1
Fulton	124	50	40.3	10	20.0	7	14.0	7	14.0	2	4.0	5	10.0
St. Lawrence	247	108	43.7	32	29.6	5	4.6	8	7.4	12	11.1	7	6.5
Essex	84	36	42.8	14	38.9	..	...	2	5.6	5	13.9	5	13.9
Broome	785	416	53.0	101	24.3	6	1.4	5	1.2	34	8.2	17	4.1
Greene	104	51	49.0	10	19.6	1	2.0	4	7.8	4	7.8	2	3.9
Westchester	1,583	496	31.3	137	27.6	28	5.6	19	3.8	28	5.6	36	7.2

* Exclusive of Syracuse

Type I pneumococci have been most frequently encountered in cases of pneumonia in the state as a whole; Type II pneumococci have been found in a relatively small proportion of the typed cases; Type V pneumococci have been encountered with greater relative frequency in New York State than in most series of cases reported. There has been considerable variation in the prevalence of these types in different areas, and in many instances this has apparently been due to localized epidemics of a homologous type.

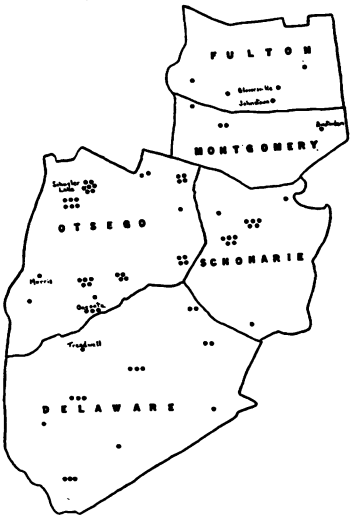
The spot maps show the grouping of cases of pneumonia according to type in an area in which detailed observations were made. Maps I, II, and III show the distribution of Types I, II, and V pneumonia respectively in 5 counties included in two state health districts. The localization by types is apparent. Epidemic areas are evident, especially for Type II and Type V. This localization is not correlated with density of population.

In view of the definite grouping of certain types of pneumococcus pneumonia, it has been considered desirable to make detailed epidemiological and bacteriological studies in areas in which epidemics occur. An epidemiological unit was organized, including a portable field laboratory, and put into service in January, 1939.

Field studies were carried out in the following three isolated communities in New York State. The first survey

MAP I

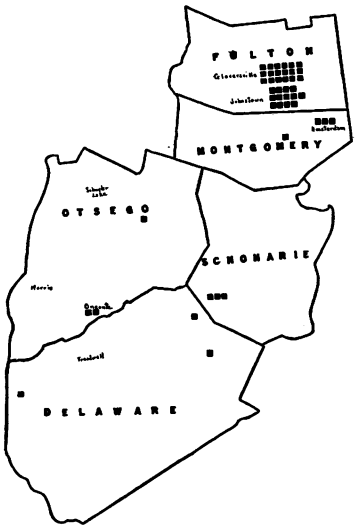
DISTRIBUTION OF TYPE I PNEUMOCOCCUS PNEUMONIA
JULY 1938 — JULY 1939



MAP II

DISTRIBUTION OF TYPE II PNEUMOCOCCUS PNEUMONIA

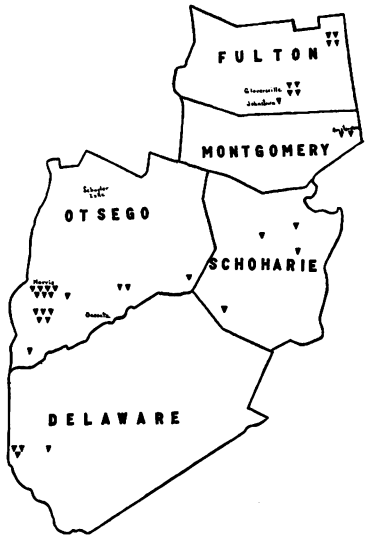
JULY 1938 – JULY 1939



MAP III

DISTRIBUTION OF TYPE V PNEUMOCOCCUS PNEUMONIA

JULY 1938 – JULY 1939



was made in Treadwell, with a population of 280, located in Delaware County midway between the west branch of the Delaware and the Susquehanna Rivers, approximately 60 miles northeast of Binghamton, and 15 miles east of Oneonta. It is located in the hills where travel in the winter is difficult.

Morris, having a population of approximately 400, is located about 30 miles west of Treadwell. It is 15 miles northwest of Oneonta.

Cannonsville, a village of 320 population, is located on the west branch of the Delaware River, 30 miles southwest of Treadwell. There were no industries in operation in any of the three villages and none was located on a main highway or on a railroad.

Cultural surveys were carried out in each of the study areas. Nasal cultures were obtained by passing a sterile swab through each nostril into the nasopharynx. A second swab was used for obtaining the throat culture, and special care was observed to swab as much of the oral pharynx as possible, including the tonsils, and especially the crypts of the tonsils if present. Both swabs were inoculated directly into Avery's blood broth. During the early part of the first study, separate broth tubes were used for the nose and throat.

Cultures were transported to the field laboratory for incubation, with a delay of not more than 2 to 5 hours. After incubation for 6 hours, all cultures were tested for pneumococci by the Neufeld method and by mouse inoculation. All identifications were confirmed either by the Otsego County Laboratory or by the Division of Laboratories and Research of the State Department of Health.

In Treadwell, the field laboratory completed the identification of Type I pneumococci, and in Morris of Type V. In Cannonville the field laboratory completed the identification of both Type I and Type V pneumococci. All other strains isolated were identified in the Division of Laboratories and Research or in the Otsego County Laboratory.

TREADWELL STUDY

In December, 1938, Dr. George M. Mackenzie of Cooperstown had undertaken a study in the isolated village of Schuyler Lake in the northwest corner of Otsego County, where an epidemic prevalence of Type I pneumococcus pneumonia was occurring. A preliminary carrier survey made by him showed a high prevalence of carriers of Type I pneumococci among the residents. In order to compare the prevalence of carriers of various types of pneumococci in isolated villages, it seemed desirable to undertake a carrier survey in a village in which no pneumonia had occurred for a considerable time. Treadwell was selected because no known cases of pneumonia had occurred during the preceding 8 months, and no known Types I, II, and V pneumonia had occurred in the village for at least 2 years. Any contact between residents of Schuyler Lake and Treadwell seemed unlikely because of their wide separation.

A survey in this area was started January 23, 1939, and completed March 21, and while no unusual prevalence of respiratory infection had been noted, preliminary tabulation of the first bacteriological findings revealed the startling fact that approximately 25 per cent of the individuals cultured were carriers of Type I pneumococcus.

In the course of the study, it was learned that on January 31 a resident of Treadwell had become ill and was removed to a hospital in a village approximately 12 miles distant. Inquiries made it clear that this patient had suffered from lobar pneumonia, but unfortunately his sputum was not typed, nor was blood culture taken. Nasal and throat cultures obtained from the patient approximately 3 weeks after onset contained Type I pneumococci. Repeated culturing showed him to be a persistent carrier of Type I and mouse protection tests showed that his serum contained antibodies specific for Type I in high titer. It seems reasonable to assume, therefore, that this patient, who became ill January 31, suffered from Type I pneumococcus pneumonia. It is of special interest that of 34 individuals in Treadwell cultured previous to the onset of illness in this case, 11, or approximately 30 per cent, were found to be carriers of Type I pneumococcus, indicating a high prevalence of Type I infection in the area preceding the onset of the first case of pneumonia.

A second case of pneumonia had onset February 5; this was a typical case of lobar pneumonia, and sputum typed early in the illness showed Type I pneumococcus. Two other cases occurred during the spring of 1939, one believed to be due to Type XXVIII pneumococcus, and the other to "streptococci." These 4 cases of pneumonia, in two of which Type I was believed to have been the etiological agent, occurred during 3½ months. While this represents an attack rate in excess of that prevailing in Otsego County or similar areas, it would not generally have been regarded as constituting an epidemic. The care with which the survey was made would seem to justify the conclusion that there were no other cases.

Cultures were obtained from 191 persons residing in the village, and Type I pneumococcus was definitely the predominant type encountered in Treadwell. As shown in Table 2, 32, or 17 per cent, of the 191 individuals cultured were found to be carriers of this microörganism. Twelve of the individuals cultured were household contacts of the 2 cases of Type I pneumococcus pneumonia and of these, 5 were found to be carriers of Type I pneumococcus. Seventeen different types were isolated, as shown in Table 3. Other than Type I, Types XV and XXIX were the most frequently encountered. Twenty-two per cent of those cultured were carriers

TABLE 2

Results of Nose and Throat Cultures among Persons Cultured, Exclusive of Cases, in Treadwell, N. Y., January 23 to March 21, 1939

	Number of Persons			Per cent of Total		
Results of Culture	*Under 20 Years*	*20 Years and Over*	*Total*	*Under 20 Years*	*20 Years and Over*	*Total*
Type I pneumococcus	22	10	32	33.8	7.9	16.7
All other types	22	20	42	33.8	15.9	22.0
Total positive	44	30	74	67.7	23.8	38.7
Total negative	21	96	117	32.3	76.2	61.3
Individuals cultured *	65	126	191	100.0	100.0	100.0

* There were 8 multi-type individuals

TABLE 3

Prevalence of Carriers of Pneumococci in Treadwell, N. Y., as Shown by Survey, January 23 to March 21, 1939, According to Age and Type

	Number of Carriers		
Type of Pneumococcus	*Under 20 Years*	*20 Years and Over*	*Total*
I	22	10	32
XV	7	2	9
XXIX	2	5	7
VI	1	3	4
XIX	3	1	4
III	3	..	3
IV	2	1	3
XVII	..	2	2
XVIII	2	..	2
XXI	..	2	2
VIII	1	..	1
IX	..	1	1
XI	..	1	1
XIII	..	1	1
XIV	1	..	1
XX	1	..	1
XXVIII	..	1	1
XXXI	..	1	1
Not classified	4	2	6
Total positive	49	33	82

of types other than Type I. The prevalence of both the predominating type and all other types was higher in young persons.

MORRIS STUDY

During the study in Treadwell, it was noted that an unusual prevalence of Type V pneumococcus pneumonia was occurring in the village of Morris. Investigation revealed that 21 cases of pneumonia had occurred in this village or within a radius of 7 miles during the period November 24, 1938, to February 28, 1939. As shown in Table 4, of these 21 cases, sputum from 18 had been typed and in 14 Type V pneumococcus had been found. The population of the village and of the area included within the 7 mile radius in which the cases occurred was approximately 2,000. The occurrence of 14 cases of Type V pneumonia in this group obviously constituted an epidemic.

Epidemiological histories were obtained from 400 individuals, exclusive of cases, and of these, 272 were cultured between February 7 and March 21. The survey procedure in this area differed from that in either Treadwell or Cannonsville in that 3 different groups were cultured; first, family contacts of cases of Type V pneumonia; second, extra-familial contacts of these case families which were for the most part neighbors having frequent associa-

TABLE 4

Cases of Pneumonia, Morris, N. Y., and Vicinity

Winter of 1938–1939

Case	*Age*	*Sex*	*Date of Onset*	*Type*
R.S.	12	M	11/24	Not typed
D.V.	20	M	11/30	V
B.B.	6	F	12/1	Not typed
H.W.	47	M	12/13	V and VIII
J.D.	10	M	12/27	V
C.G.	37	M	1/15	V
D.P.J.	13	M	1/16	V
A.G.	64	M	1/17	XXIX
W.S.	56	M	1/19	V
L.R.	2	F	1/21	V
E.V.W.	74	F	1/24	Not typed
B.C.	5	F	1/26	V
C.J.	8	M	1/27	V
J.N.	6	M	1/29	XVII
V.H.	46	M	2/6	V
R.D.	47	M	2/7	V
M.E.F.	78	F	2/16	IX
C.P.	51	M	2/16	V
G.J.	34	F	2/24	V
W.C.	42	M	2/26	III
S.J.	59	F	2/28	V

TABLE 5

Prevalence of Carriers of Pneumococci in Morris, N. Y., and Vicinity as Shown by Survey, February 7 to March 21, 1939, According to Age and Type

Type of Pneumococcus	Number of Carriers: Under 20 Years	20 Years and Over	Total
III	4	7	11
V	9	2	11
VIII	3	4	7
XIX	5	2	7
VI	4	2	6
XXIX	3	2	5
XVII	4	..	4
XVI	1	2	3
XVIII	2	1	3
XI	2	..	2
XIV	2	..	2
XXIII	1	1	2
XXVII	2	..	2
I	1	..	1
VII	..	1	1
XV	1	..	1
XXII	1	..	1
XXVIII	1	..	1
Not classified	4	3	7
Total positive	50	27	77

tion with the case family, although direct contact with the case did not always occur; and third, a random sample of the population of the village. The sample of the population was obtained by taking cultures from alternate individuals named on the family rosters.

Type V and Type III predominated in this area and were of equal frequency. Eleven carriers of each of these types were found. In view of reported findings in carrier surveys, this number of carriers of Type III was not considered remarkable. Only one carrier of Type I pneumococcus and no carriers of Type II were encountered in the study. As shown in Table 5, 17 types other than Type V were isolated.

Table 6 shows the results of culturing according to predominating type (Type V) and other types isolated by age groups. It may be noted that the proportion of carriers of Type V, as well as of all other types, was higher in the younger age group. In the entire group cultured, only 4.4 per cent carried the predominating pneumococcus (Type V) whereas in Treadwell, 16.7 per cent were carriers of the predominating microörganism (Type I).

Table 7 shows the prevalence of

TABLE 6

Results of Nose and Throat Cultures Among Persons Cultured, Exclusive of Cases, in Morris, N. Y., and Vicinity, February 7 to March 21, 1939

Results of Culture	Number of Persons: Under 20 Years	20 Years and Over	Total	Per cent of Total: Under 20 Years	20 Years and Over	Total
Type V pneumococcus	9	2	11	9.1	1.3	4.4
All other types	38	24	62	38.4	15.8	24.7
Total positive	47	26	73	47.5	17.1	29.1
Total negative	52	126	178	52.5	82.9	70.9
Individuals cultured *	99	152	251	100.0	100.0	100.0

* There were 3 multi-type individuals, one of whom was positive for three types.

TABLE 7

Prevalence of Carriers of Type V Pneumococcus According to Age and Intimacy of Contact with Cases of Type V Pneumonia, Morris, N. Y., February 7 to March 21, 1939

Age	Number Cultured: Household Contacts	Extra Household Contacts	No Contact	Number Positive: Household Contacts	Extra Household Contacts	No Contact	Per cent Positive: Household Contacts	Extra Household Contacts	No Contact
0–19	33	13	53	7	..	2	21.2	...	3.7
20+	31	43	78	1	1	..	3.2	2.3	...
Total	64	56	131	8	1	2	12.5	1.8	1.5

Type V carriers in household contacts as compared with extra-familial contacts and in the random sample of the population of the village. The prevalence of carriers of Type V pneumococcus was distinctly higher in household contacts of cases of Type V pneumonia than in the other groups. The fact that the household contacts of cases were the first group cultured in Morris may have some bearing on the results of culture.

TABLE 8

Prevalence of Carriers of Pneumococci in Cannonsville, N. Y., as Shown by Survey, March 27 to April 13, 1939, According to Age and Type

Type of Pneumococcus	Number of Carriers: Under 20 Years	20 Years and Over	Total
VI	11	9	20
XI	2	7	9
XVIII	3	3	6
III	2	3	5
XXII	5	..	5
XIX	4	..	4
XXV	2	..	2
XIV	2	..	2
IV	..	1	1
VIII	..	1	1
XV	..	1	1
XX	1	..	1
XXI	1	..	1
XXIV	..	1	1
Not classified	2	2	4
Total positive	35	28	63

CANNONSVILLE STUDY

In a further attempt to obtain information as to the prevalence of carriers of pneumococci in an isolated village in which no cases of pneumonia had occurred recently, a survey was made in Cannonsville. Careful investigation revealed no evidence of any illness suggestive of pneumonia in the village or its vicinity from July 1, 1938, throughout the study. It is believed that the 307 persons from whom histories were obtained included almost every individual resident in the village at the time. In cultures from 199 individuals, 14 different types were isolated. As shown in Table 8, there were 20 carriers of Type VI pneumococci and 43 carriers of other types. Other than Type VI, Types XI and XVIII were the most frequently encountered. No carriers of Types I, II, V, or VII were found.

Table 9 shows the proportion of individuals cultured found to be carriers of Type VI and of all other types. It may be noted that 32 per cent of the individuals cultured were found to be carriers of some type of pneumococcus and that 10 per cent were found to be carriers of Type VI. Here, as in the other survey areas, the prevalence of carriers of pneumococci of all types was higher in younger individuals.

Table 10 compares the prevalence of carriers of all types of pneumococci in the three areas studied. The carrier rate was highest in Treadwell, especially in the age group under 20.

In Morris and Cannonsville, history was obtained as to the occurrence of upper respiratory illness during the 30 days preceding culture. Sixty-two per cent of the individuals interviewed in Morris gave a history of illness. The

TABLE 9

Results of Nose and Throat Cultures among Persons Cultured in Cannonsville, N. Y., March 27 to April 13, 1939

Results of Culture	Number of Persons: Under 20 Years	20 Years and Over	Total	Per cent of Total: Under 20 Years	20 Years and Over	Total
Type VI Pneumococcus	11	9	20	12.3	8.2	10.1
All other types	24	19	43	27.0	17.3	21.6
Total positive	35	28	63	39.3	25.5	31.7
Total negative	54	82	136	60.7	74.5	68.3
Individuals cultured	89	110	199	100.0	100.0	100.0

TABLE 10

Persons Cultured, Number and Per cent Found to Be Pneumococcus Carriers, by Age in the Three Study Areas

	Number Cultured			Number of Carriers			Carrier Rates Per cent			
Age	Treadwell	Morris	Cannonsville	Treadwell	Morris	Cannonsville	Treadwell	Morris	Cannonsville	Total
0–19	65	99	89	44	47	35	67.7	47.5	39.3	49.8
20+	126	152	110	30	26	28	23.8	17.1	25.5	21.6
Total	191	251	199	74	73	63	38.7	29.1	31.7	32.8

attack rate was higher in the group under 20 years of age.

Four cases of purulent otitis media were observed, 2 in cases of Type V pneumococcus pneumonia, 1 in an otherwise healthy carrier of Type V, and 1 in an individual whose throat culture was negative. Simple earache occurred in 13 persons: 2 cases of pneumonia, 1 Type V, and 1 untyped; 1 otherwise healthy carrier of Type V pneumococcus; 5 carriers of pneumococci of other types; and 5 individuals whose nose and throat cultures were negative for pneumococci.

History of recent respiratory illness was obtained less frequently in Cannonsville than in Morris. Thirty-eight per cent of those cultured had suffered from some mild upper respiratory illness in the 30 days preceding the culture. Three cases of acute suppurative otitis media occurred during this time, 1 in a carrier of Type III pneumococcus, and 2 in persons whose nose and throat cultures were negative for pneumococci. Four individuals suffered from simple earache, 2 of whom were found to be carriers of other than the predominating type, and 2 had negative nose and throat cultures.

Table 11 summarizes the prevalence of carriers of *all* types, according to age and history of illness in Morris and Cannonsville. Association of the carrier condition with illness seems to be indicated only in the younger age group.

Table 12 shows the prevalence of carriers of the predominating type of pneumococcus, and the prevalence of all other types according to age and prior illness. In Morris, the prevalence of carriers of the predominating type (Type V) was greater in those with prior illness in both age groups. In Cannonsville, the prevalence of carriers of the predominant type (Type VI) was higher in those with prior illness

TABLE 11

Number of Persons Cultured, and Per cent Found to Be Pneumococcus Carriers (All Types) According to Prior Respiratory Illness in Morris and Cannonsville

	History of Respiratory Illness					
	Number Cultured			Per cent Pneumococcus Carriers, All Types		
Place	Under 20 Years	20 Years and Over	All Ages	Under 20 Years	20 Years and Over	All Ages
Morris	73	83	156	50.7	16.9	32.7
Cannonsville	34	42	76	47.1	26.2	35.5
	No History of Respiratory Illness					
	Number Cultured			Per cent Pneumococcus Carriers, All Types		
Place	Under 20 Years	20 Years and Over	All Ages	Under 20 Years	20 Years and Over	All Ages
Morris	26	69	95	38.5	17.4	23.2
Cannonsville	55	68	123	34.5	25.0	29.3

TABLE 12

Pneumococcus Carrier Rates Per cent of Predominating Type and of All Other Types According to Age and Prior Respiratory Illness in the Three Study Areas

	Carrier Rates Per cent—Predominating Type					
	Under 20 Years		*20 Years and Over*		*Total*	
Place	*History of Illness*	*No Illness*	*History of Illness*	*No Illness*	*History of Illness*	*No Illness*
Morris	11.0	3.8	2.4	...	6.4	1.1
Cannonsville	26.5	3.6	7.1	8.8	15.8	6.5

	Carrier Rates Per cent—All Other Types					
	Under 20 Years		*20 Years and Over*		*Total*	
Place	*History of Illness*	*No Illness*	*History of Illness*	*No Illness*	*History of Illness*	*No Illness*
Morris	39.7	34.6	14.5	17.4	26.3	22.1
Cannonsville	20.6	30.9	19.0	16.2	19.7	22.8

only in the younger age group. There was very little difference in the prevalence of carriers of other than the predominating type in either Morris or Cannonsville, according to history of illness.

DURATION OF CARRIER STATE

An attempt was made to reculture all of the individuals, exclusive of cases, known to be carriers of Type I pneumococcus in Treadwell or of Type V pneumococcus in Morris. Repeated

TABLE 13

Pneumococcus Carrier Rates Per cent of Predominating Type and of Other Types According to Prior Respiratory Illness Corrected for Age*

	Corrected Carrier Rates Per cent*			
	Predominating Type		*Other Types*	
Place	*History of Illness*	*No Illness*	*History of Illness*	*No Illness*
Morris	5.8	1.5	24.4	24.2
Cannonsville	14.7	6.7	19.6	22.0

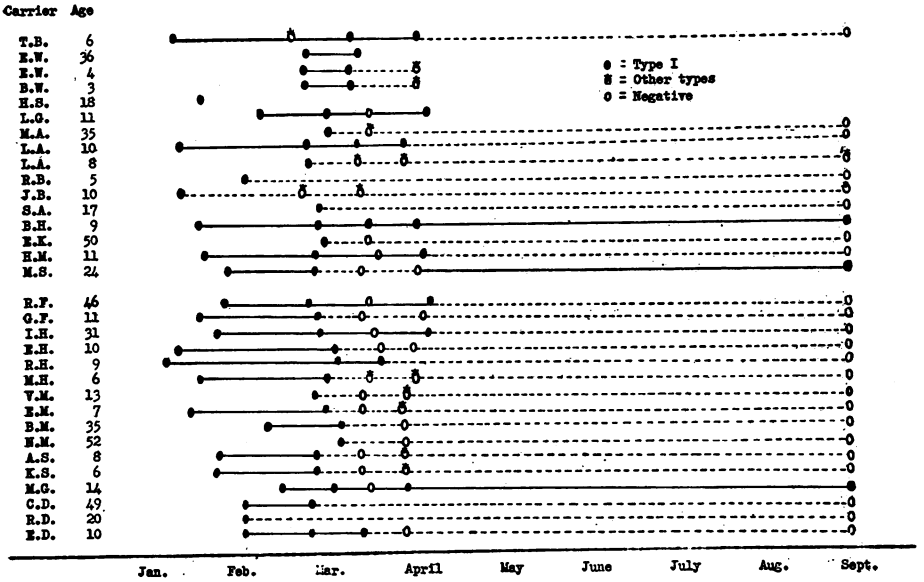
* Age correction made by using entire population cultured

Table 13 shows the prevalence of carriers of the predominant type and all other types in Morris and Cannonsville, corrected for age, using the entire cultured population of the three areas for age correction. In both Morris and Cannonsville, the prevalence of carriers of the predominating type was higher in those with a history of prior illness, but the differences are not statistically significant. There was no difference in the observed prevalence of carriers of types other than the predominant type according to history of illness in either area.

cultures were obtained from 31 of the 32 carriers of Type I pneumococcus in Treadwell. Twenty-two of these were found to continue to carry this type of pneumococcus for from 2 weeks to 3 months, and reculturing of 27 of the original 32 approximately 7 months later showed that 3 were carriers of Type I pneumococcus at that time. Figure 4 shows the duration of the carrier state of the Type I carriers as indicated by reculturing.

Repeated cultures were taken on the Type V carriers at Morris at intervals of approximately 2 weeks. In only 5

FIGURE 4—Duration of Type I Carrier State as shown by repeated culturing
Treadwell, N. Y.

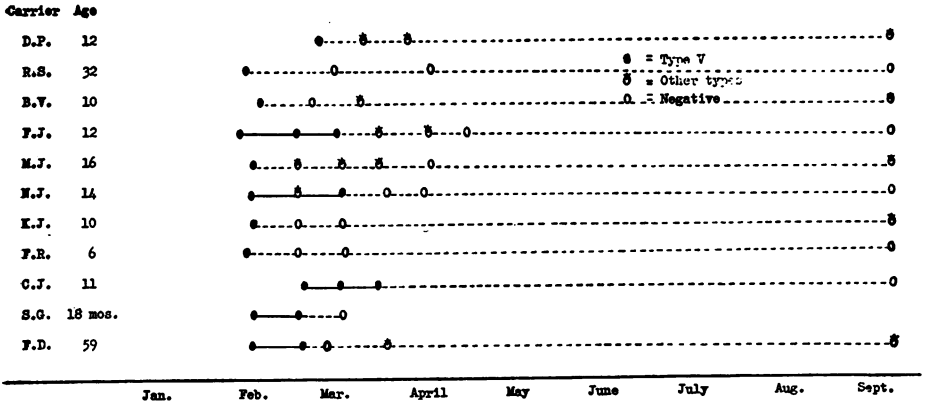


individuals were more than one positive culture obtained. The carrier condition was shown to have persisted for at least 2 weeks in 1, and for at least 1 month in 2 of the original carriers. Nine of the original carriers were recultured 6 months later, and none was found to be a carrier of Type V pneumococcus. Figure 5 shows the results of repeated culturing in persons found to be carriers of Type V during the survey. A comparison of these two series of observations shows a difference in the duration of the carrier state which apparently may vary according to type.

SUMMARY AND CONCLUSIONS

Pneumococcus carrier surveys were made in three isolated rural areas in New York State, in one of which at

FIGURE 5—Duration of Type V Carrier State as shown by repeated culturing
Morris, N. Y.



the time of the beginning of the study no cases of pneumonia had occurred for a considerable time, yet a high prevalence of carriers of Type I pneumococcus was found. Subsequent to the beginning of the study, 2 cases of Type I pneumonia occurred in this area. The prevalence of Type I pneumonia in this community could hardly be regarded as constituting an epidemic and yet a carrier prevalence was observed in the general population fully as high as or higher than that usually encountered among contacts to cases. Moreover, this marked prevalence of carriers of Type I pneumococci preceded the occurrence of the first case of pneumonia. No Type V carriers were discovered in this survey.

In the survey carried out in an area in which Type V pneumococcus pneumonia was present in epidemic proportions, more carriers of the homologous type of pneumococcus were found than of any type other than Type III, but these were confined almost exclusively to household contacts to known cases of Type V pneumonia. Only one carrier of Type I pneumococcus was found in this area.

A similar study in a third village in which no pneumonia had occurred for at least 6 months preceding the survey revealed no carriers of Type I or V pneumococci. Type VI was found to be the predominating type of pneumococcus in this area.

Respiratory illnesses other than pneumonia were more prevalent in the area in which Type V pneumonia was highly prevalent than in the area in which there were no cases of pneumonia. There was a slightly higher prevalence of carriers of pneumococci of the predominant type among persons in the younger age group who gave a history of respiratory illness other than pneumonia in both areas but these differences were not statistically significant.

The findings in these surveys seem to indicate that:

1. Infection with Type I pneumococcus may be widespread in the absence of a high prevalence of Type I pneumococcus pneumonia and a high prevalence of carriers of Type I pneumococcus may precede the occurrence of cases.

2. Epidemics of Type V pneumonia may not be associated with a continued high prevalence of carriers of this type of pneumococcus in the general population. In the Type V epidemic studied, the prevalence of carriers of the homologous type was limited primarily to household contacts of clinical cases of pneumonia. However, the fact that the household contacts were cultured first may have some bearing on this observation, especially in view of the evidence of a short duration of the Type V carrier state.

3. There may be a relatively high prevalence of carriers of Type VI pneumococci in the absence of pneumonia due to this type.

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The Cost of Slums

THE cost of slums as noted in a recent publication of the United States Housing Authority:

A Hartford study showed that slum areas occupying a tenth of the area of the city house a fourth of the city's population. From these slum areas came 51 per cent of all tuberculosis cases, 57 per cent of all juvenile delinquency, and 62½ per cent of all arrests for adult delinquency.

This is what a study made in Cleveland showed:

Area	*Per Capita Cost for Fire Protection*	*Per Capita Cost for Police Protection*	*Per Capita Cost for Public Health Work*
One large slum area	$18.27	$11.50	$2.02
Rest of City	2.74	4.20	0.60

U. S. Municipal News, 7, 4 (Mar. 1), 1940.